US009193082B2

(12) **United States Patent**
Kawase et al.

(10) **Patent No.: US 9,193,082 B2**
(45) **Date of Patent: Nov. 24, 2015**

(54) **CUTTING PLOTTER AND NON-TRANSITORY COMPUTER-READABLE STORAGE MEDIUM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 485 days.

(21) Appl. No.: **13/851,630**

(22) Filed: **Mar. 27, 2013**

(65) **Prior Publication Data**

US 2013/0255458 A1 Oct. 3, 2013

(30) **Foreign Application Priority Data**

Mar. 27, 2012 (JP) 2012-071476

(51) **Int. Cl.**

G06F 19/00	(2011.01)
B26D 5/00	(2006.01)
B26D 5/06	(2006.01)
B26D 7/28	(2006.01)

(Continued)

(52) **U.S. Cl.**

CPC ***B26D 5/005*** (2013.01); ***B26D 5/06*** (2013.01); ***B26D 7/28*** (2013.01); ***B26F 1/3806*** (2013.01); *B26D 3/085* (2013.01); *Y10T 83/162* (2015.04)

(58) **Field of Classification Search**

CPC ... B26D 5/005; B26D 2007/2678; B26D 5/06
See application file for complete search history.

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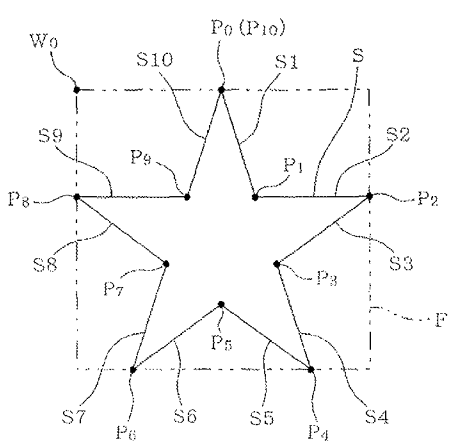
(74) *Attorney, Agent, or Firm* — Fox Rothschild LLP

(57) **ABSTRACT**

A cutting plotter includes a processor and a memory. The memory stores computer-readable instructions that cause the processor to perform setting, counting, storing, and notifying when executed. The setting sets a plurality of partial areas by dividing a cuttable area of a holding member, the cuttable area is an area in which a cutting object is to be detachably adhered. The counting counts a number of cuts by a cutting blade within the cuttable area for each of the plurality of partial areas. The storing stores each of count values associated with each of the plurality of partial areas in a storage portion, each of the count values is counted by the counting for each of the plurality of partial areas. The notifying notifies, based on the count values stored in the storage portion, information relating to the number of cuts for each of the plurality of partial areas.

14 Claims, 11 Drawing Sheets



(51) **Int. Cl.**
B26F 1/38 (2006.01)
B26D 3/08 (2006.01)

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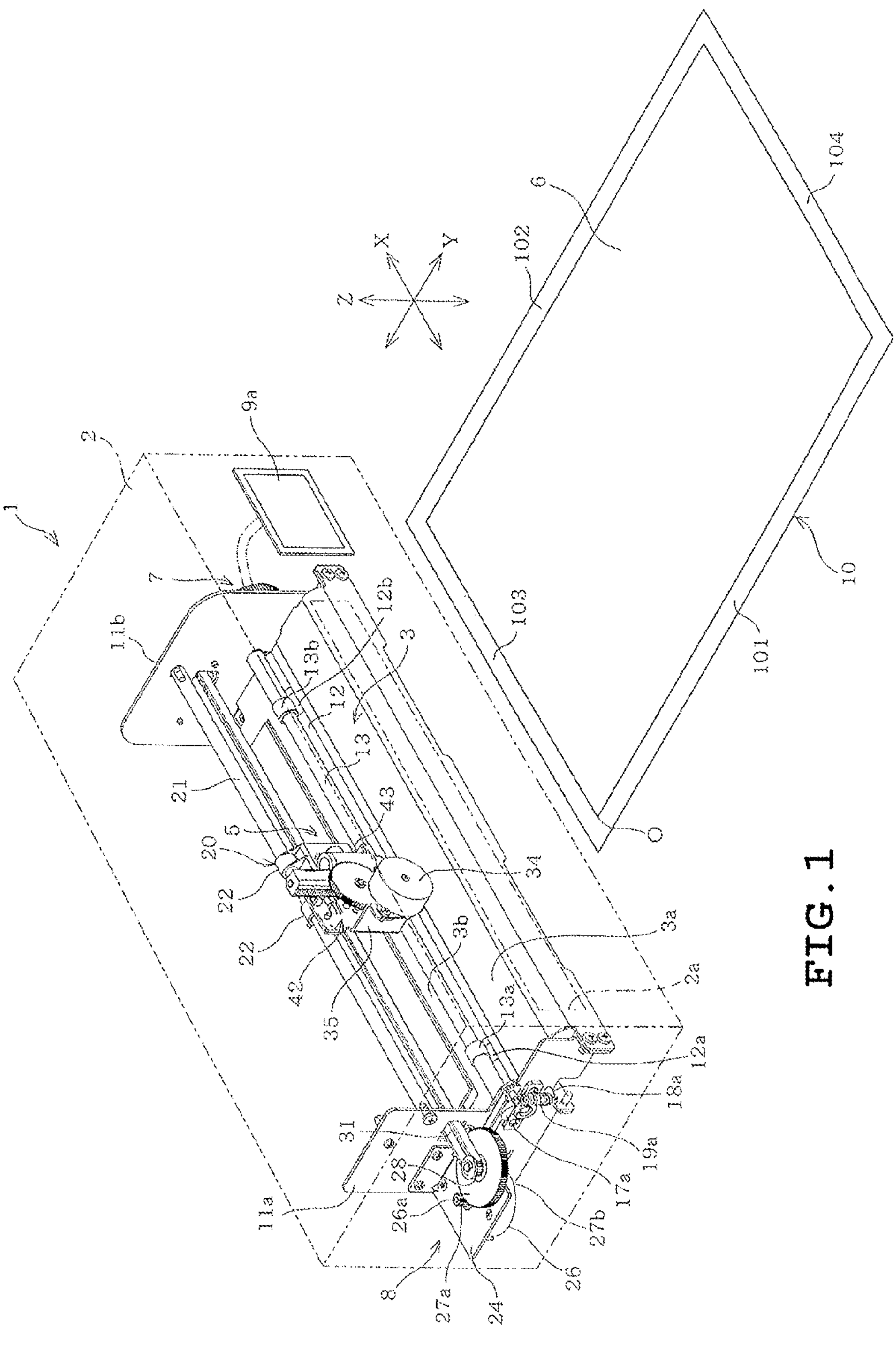
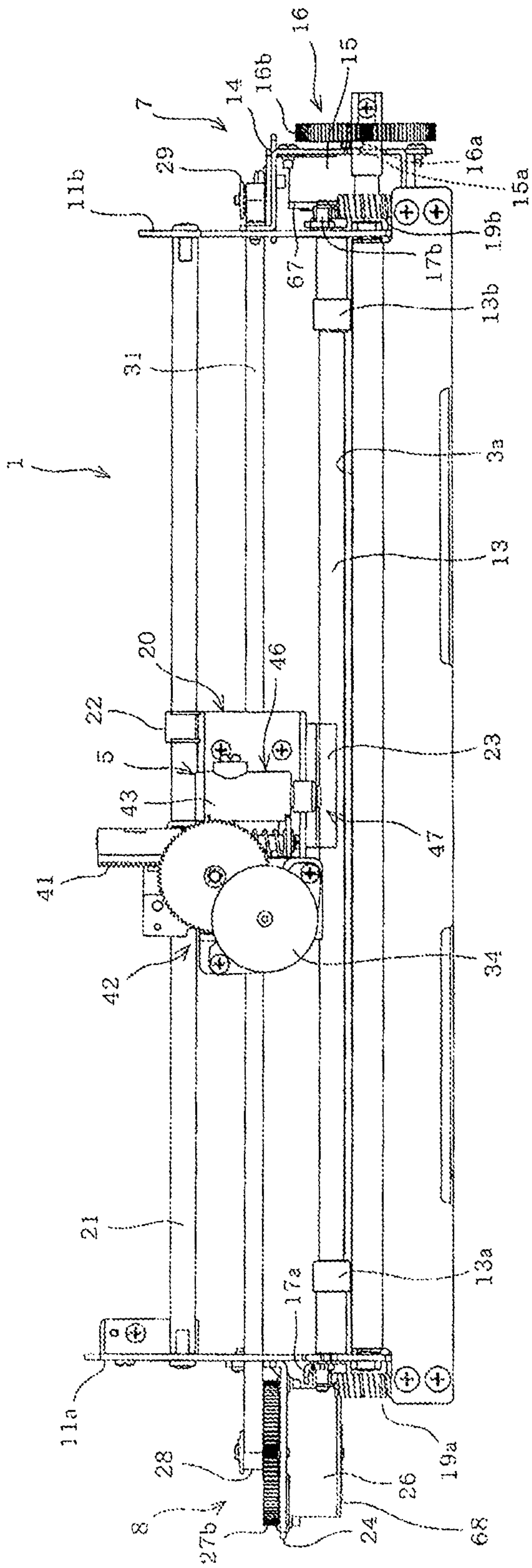

1
2
9a
7
11b
12b
13b
3
12
13
21
5
43
20
22
34
22
42
35
3b
3a
2a
13a
12a
18a
19a
17a
27b
31
28
26a
11a
8
27a
24
26
X
Y
Z
6
102
104
103
101
10
O

FIG. 1



1
5
7
8
11a
11b
13
13a
13b
14
15
15a
16
16a
16b
17a
17b
19a
19b
20
21
22
23
24
26
27b
28
29
31
34
3a
41
42
43
46
47
67
68

FIG. 2

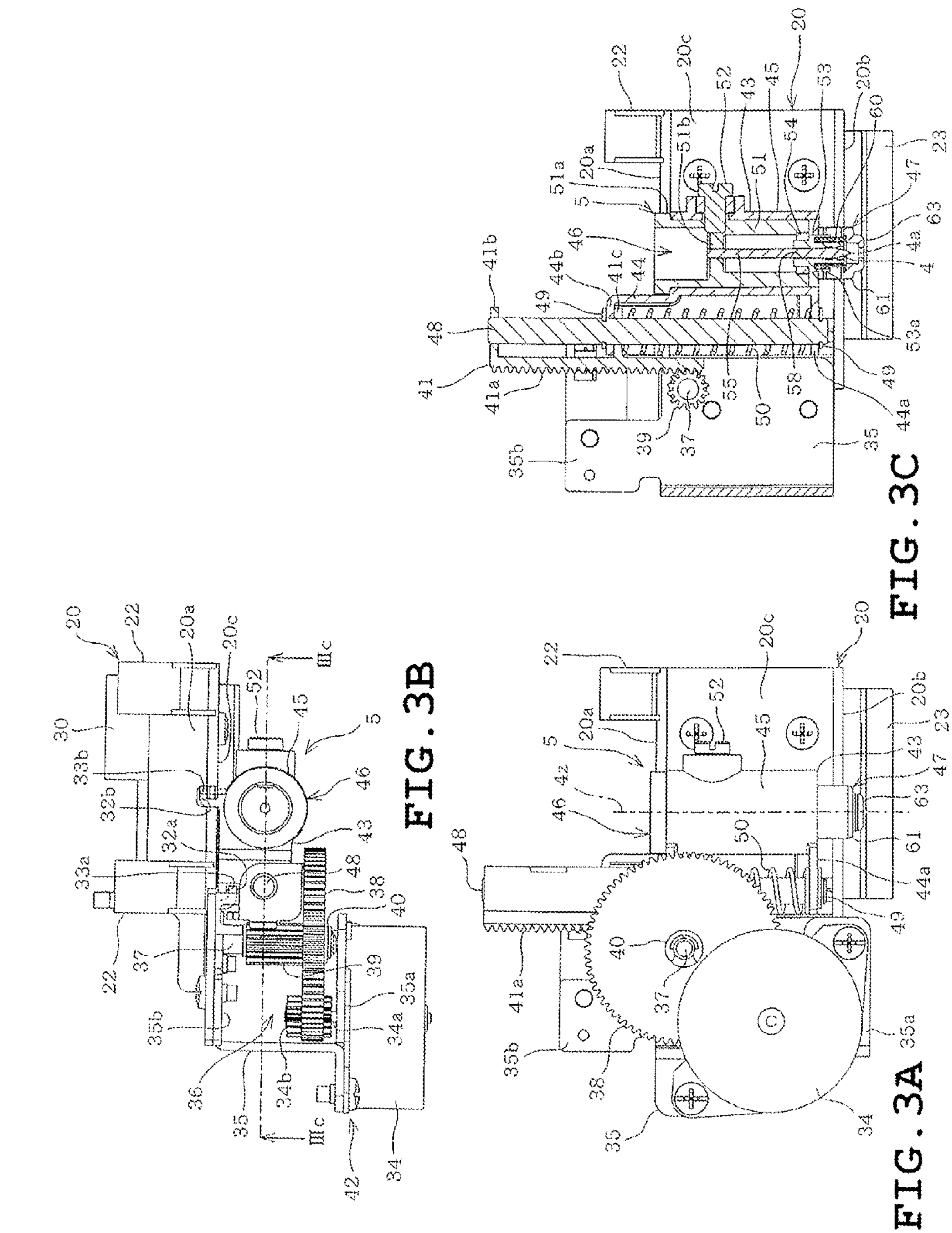


FIG. 3A

FIG. 3B

FIG. 3C

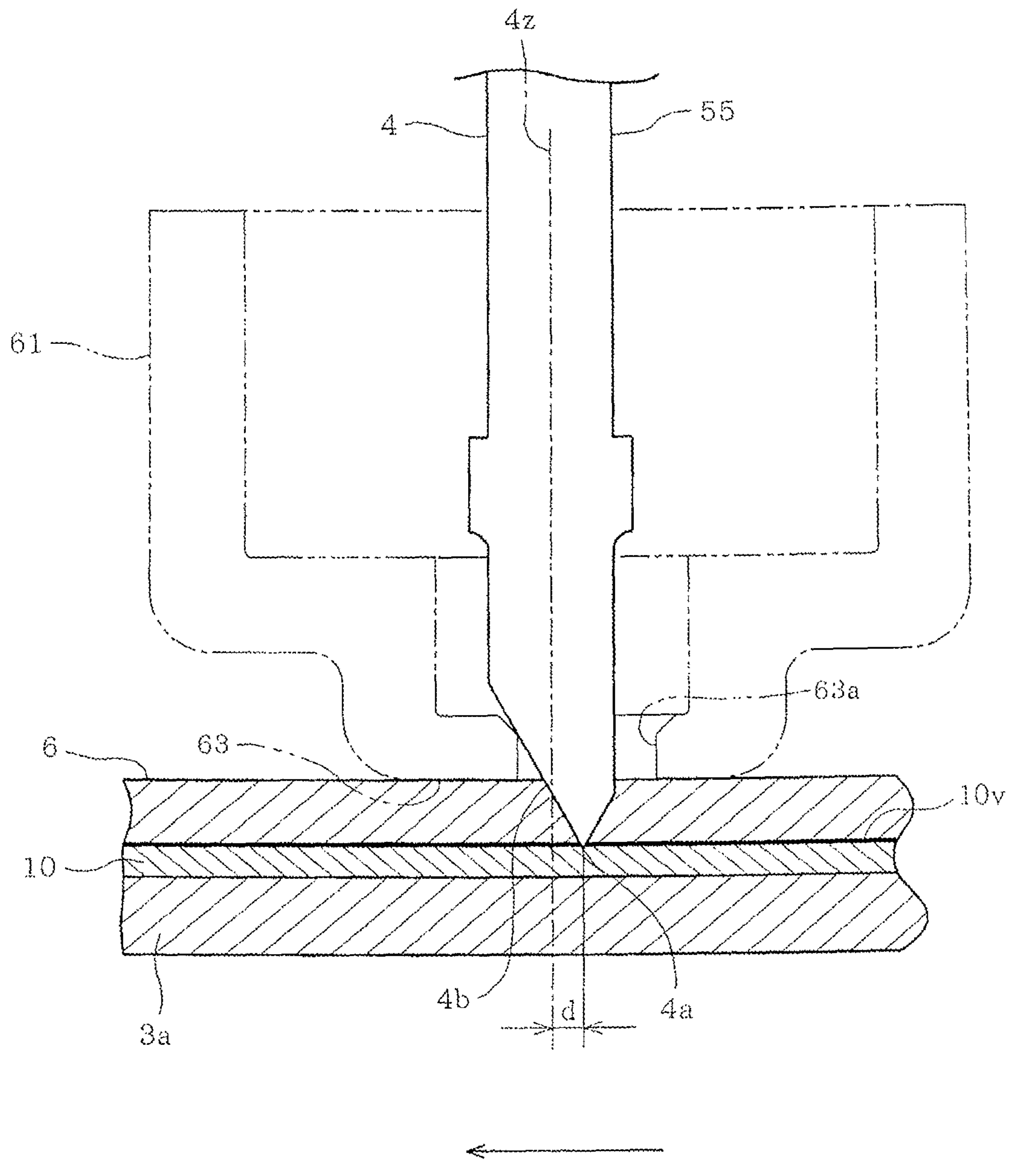


FIG. 4

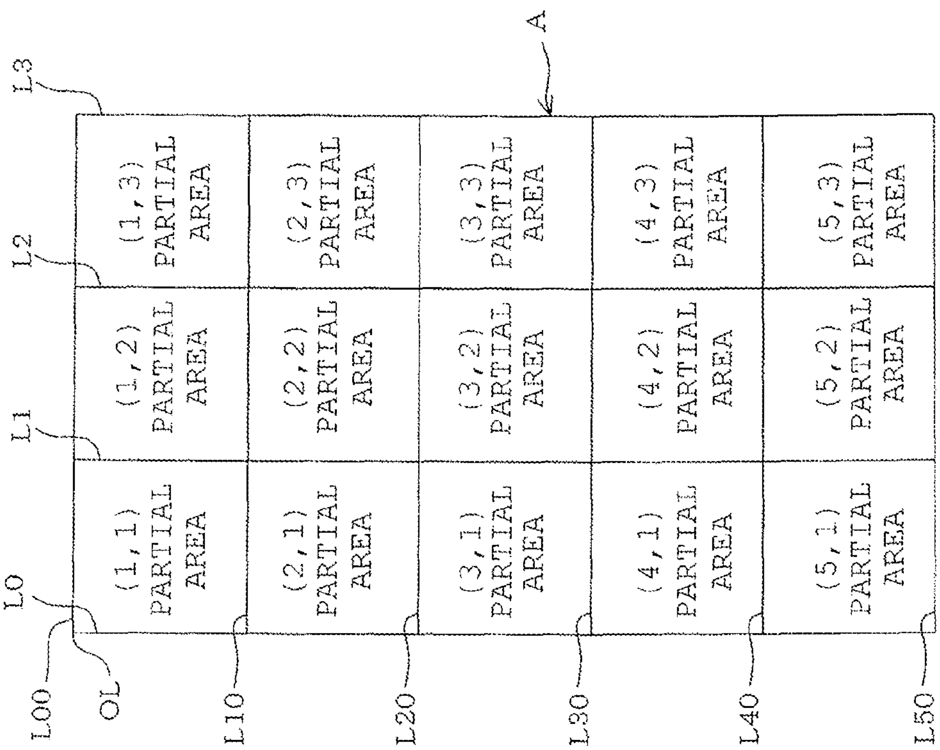

A
L3
L2
L1
L0
L00
OL
L10
L20
L30
L40
L50
(1,1) PARTIAL AREA
(1,2) PARTIAL AREA
(1,3) PARTIAL AREA
(2,1) PARTIAL AREA
(2,2) PARTIAL AREA
(2,3) PARTIAL AREA
(3,1) PARTIAL AREA
(3,2) PARTIAL AREA
(3,3) PARTIAL AREA
(4,1) PARTIAL AREA
(4,2) PARTIAL AREA
(4,3) PARTIAL AREA
(5,1) PARTIAL AREA
(5,2) PARTIAL AREA
(5,3) PARTIAL AREA

FIG.5B

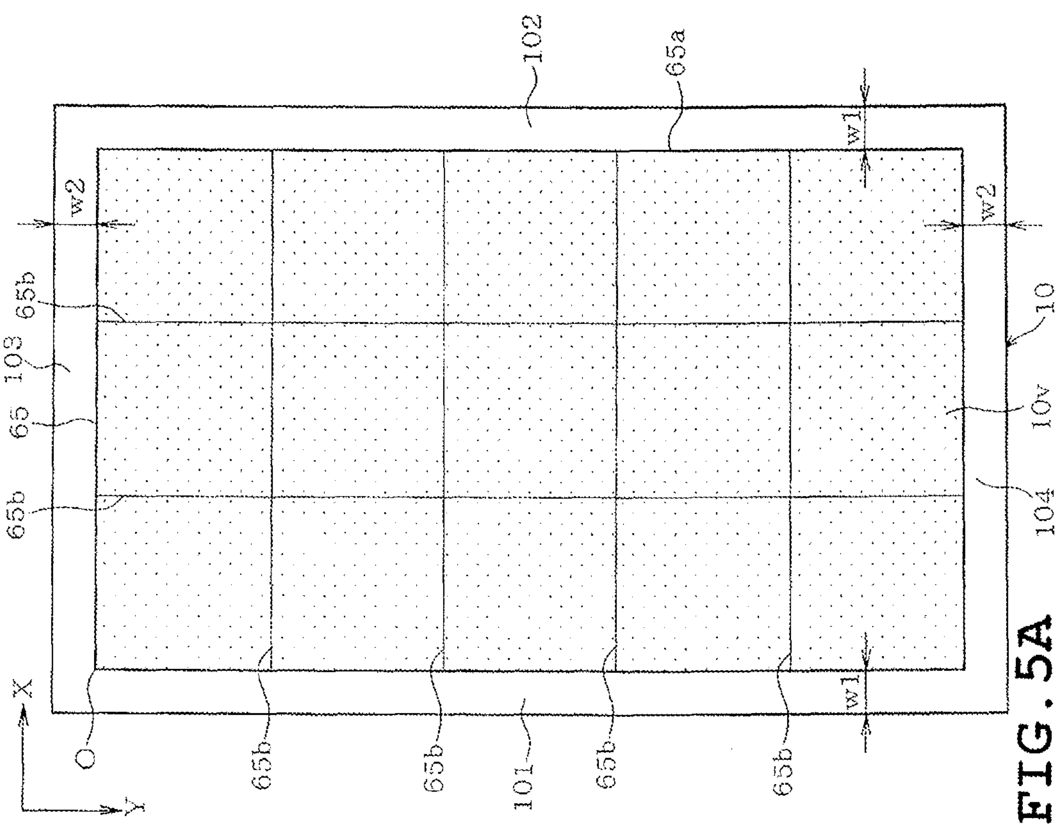

102
65a
w1
w2
65b
103
65
10
10v
104
X
Y
O
101
65b
w1
w2

FIG.5A

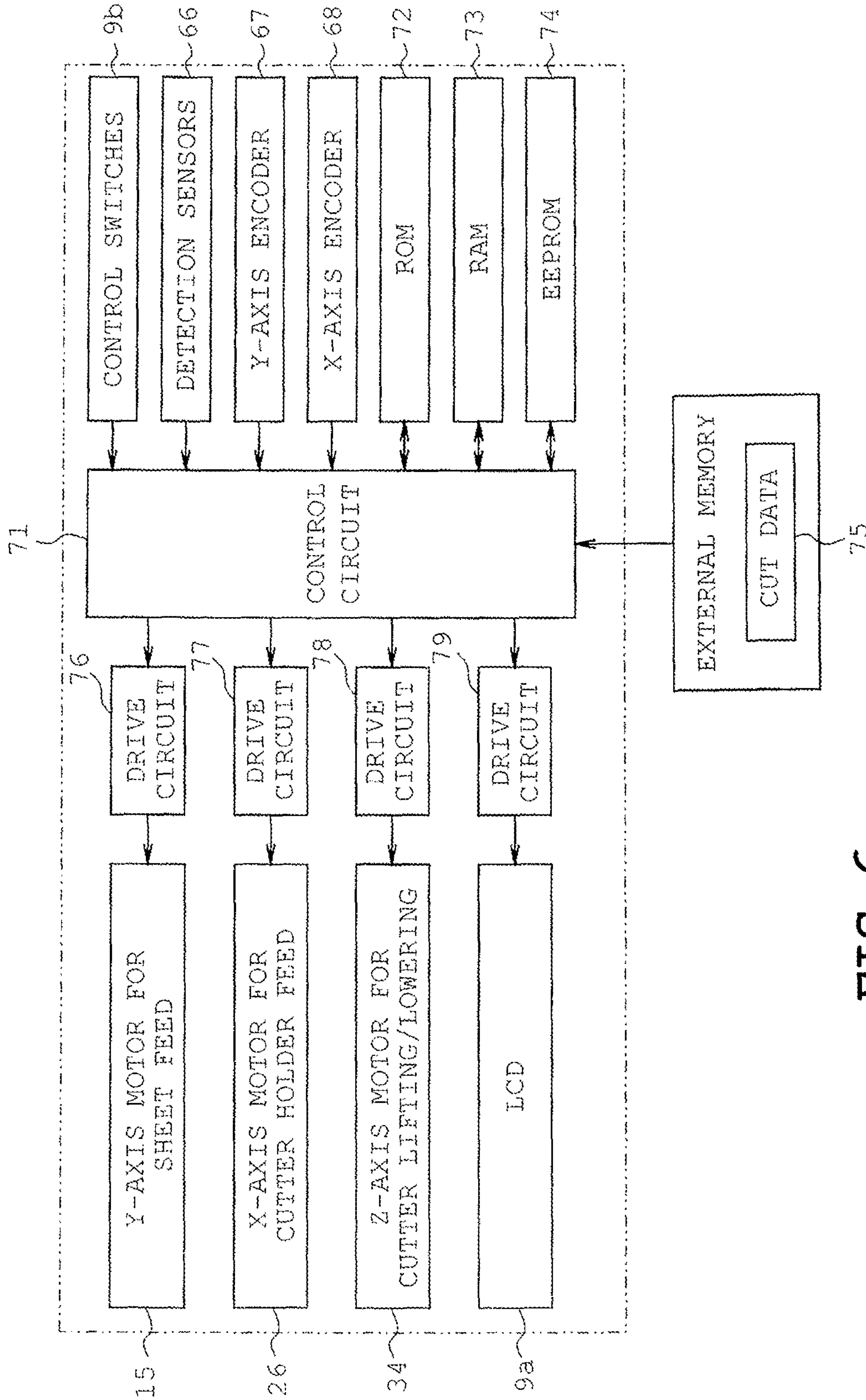

9b
66
67
68
72
73
74
CONTROL SWITCHES
DETECTION SENSORS
Y-AXIS ENCODER
X-AXIS ENCODER
ROM
RAM
EEPROM
71
CONTROL CIRCUIT
EXTERNAL MEMORY
CUT DATA
75
76
77
78
79
DRIVE CIRCUIT
DRIVE CIRCUIT
DRIVE CIRCUIT
DRIVE CIRCUIT
Y-AXIS MOTOR FOR SHEET FEED
X-AXIS MOTOR FOR CUTTER HOLDER FEED
Z-AXIS MOTOR FOR CUTTER LIFTING/LOWERING
LCD
15
26
34
9a

FIG.6

BASIC SIZE INFORMATION OF CUT DATA	LONGITUDINAL
	LATERAL
CUT LINE DATA OF CUT DATA	(X1,Y1)
	(X2,Y2)
	(X3,Y3)
	⋮

FIG. 7A

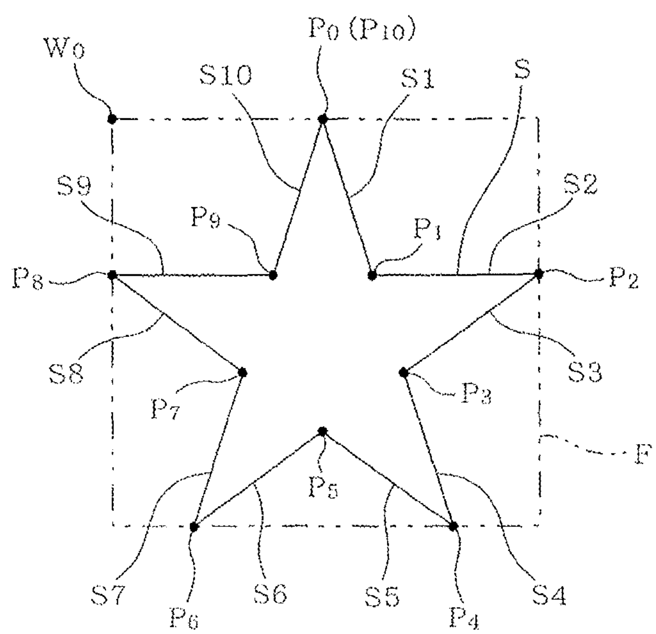


FIG. 7B

CUTTABLE AREA A	CUT COUNT cnt
(1,1) PARTIAL AREA	cnt 1
(1,2) PARTIAL AREA	cnt 2
(1,3) PARTIAL AREA	cnt 3
(2,1) PARTIAL AREA	cnt 4
(2,2) PARTIAL AREA	cnt 5
(2,3) PARTIAL AREA	cnt 6
⋮	⋮
(4,2) PARTIAL AREA	cnt 11
⋮	⋮
(5,3) PARTIAL AREA	cnt 15

FIG.8

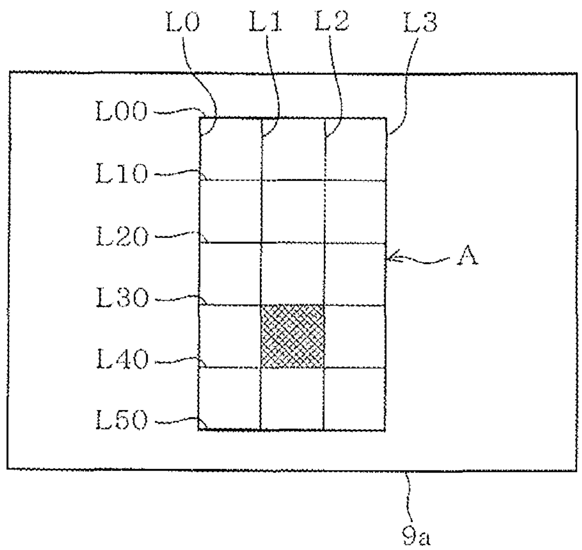


FIG. 9

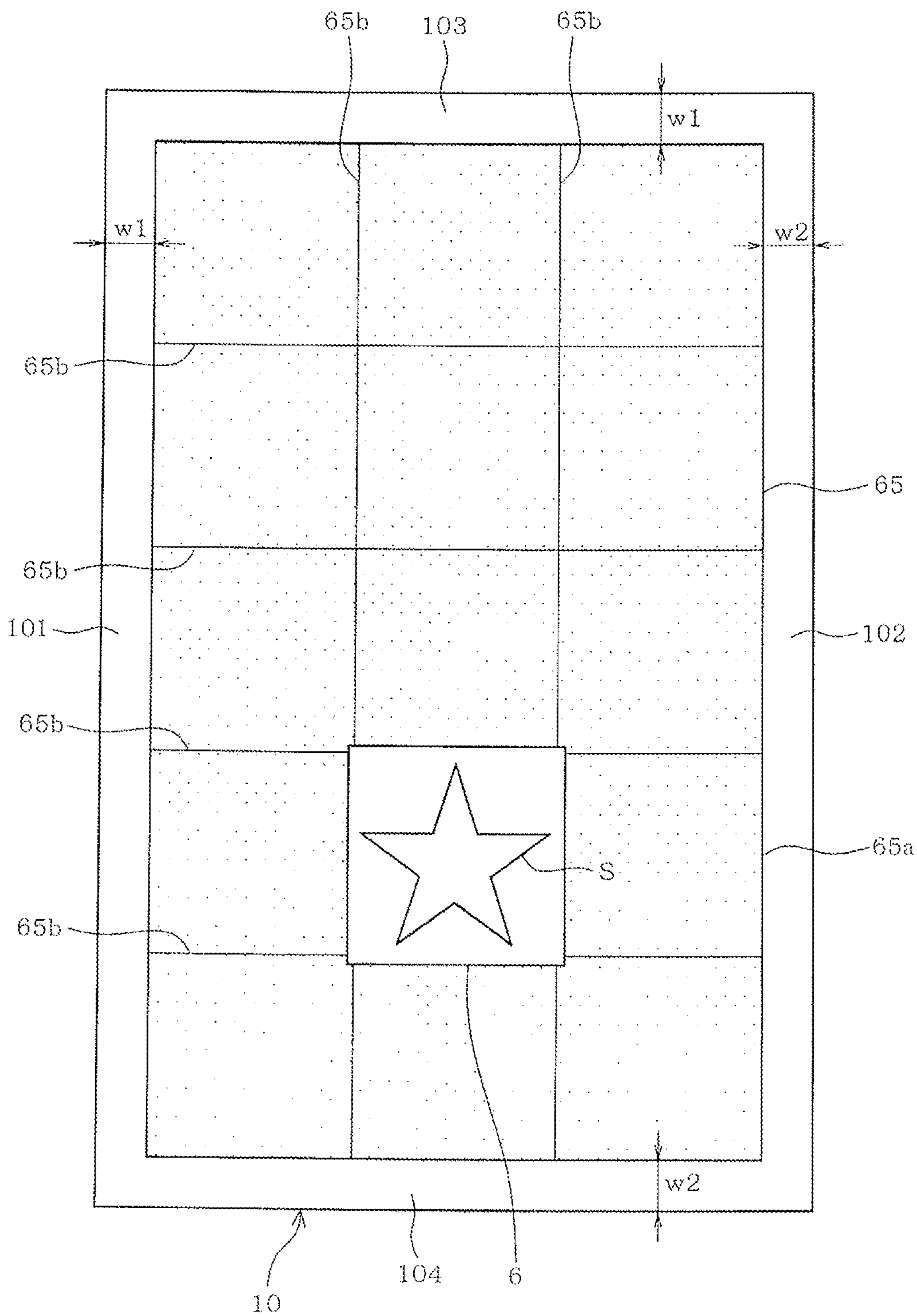


FIG. 10

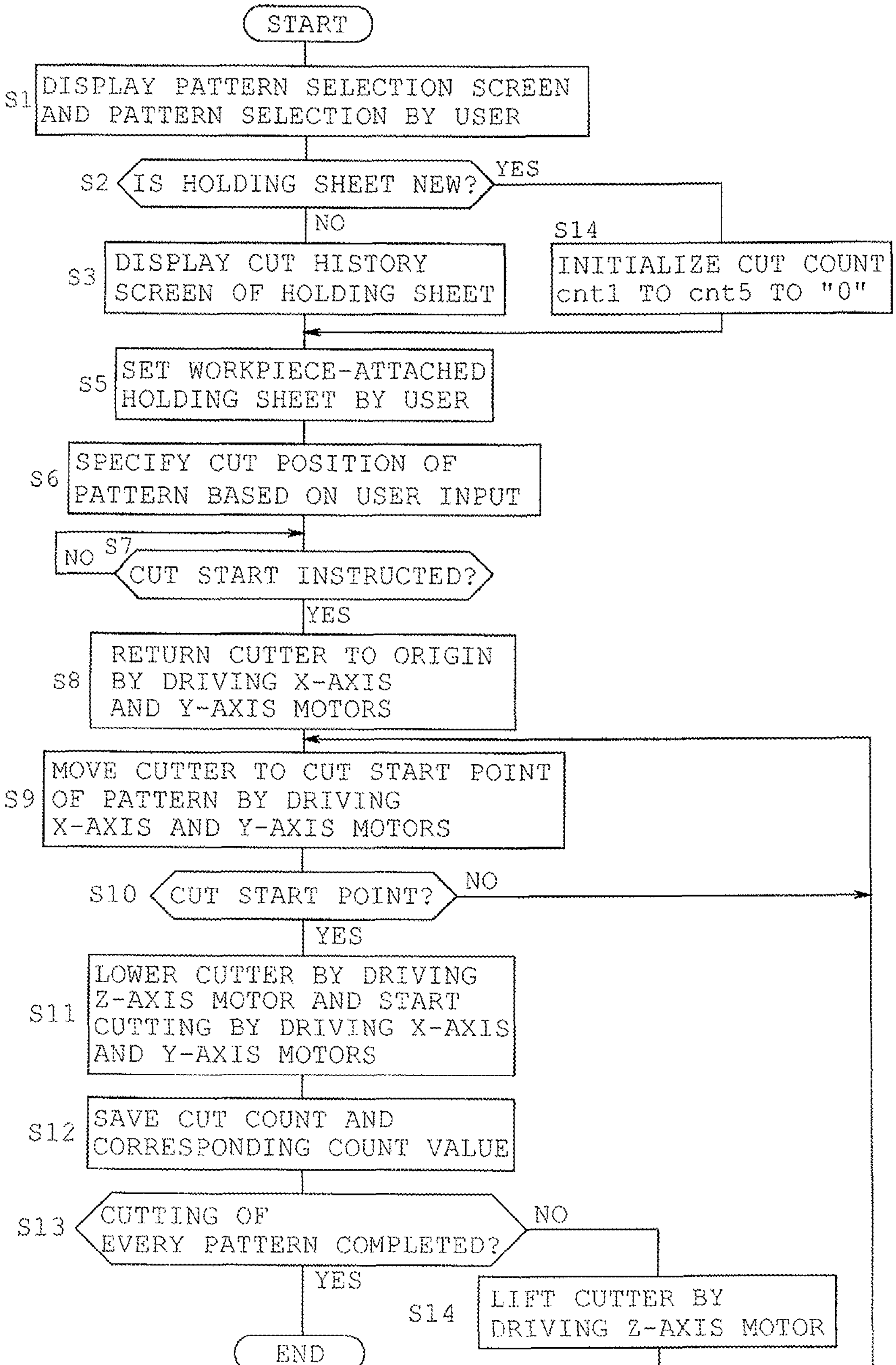

START
S1
DISPLAY PATTERN SELECTION SCREEN AND PATTERN SELECTION BY USER
S2
IS HOLDING SHEET NEW?
YES
NO
S3
DISPLAY CUT HISTORY SCREEN OF HOLDING SHEET
S14
INITIALIZE CUT COUNT cnt1 TO cnt5 TO "0"
S5
SET WORKPIECE-ATTACHED HOLDING SHEET BY USER
S6
SPECIFY CUT POSITION OF PATTERN BASED ON USER INPUT
NO
S7
CUT START INSTRUCTED?
YES
S8
RETURN CUTTER TO ORIGIN BY DRIVING X-AXIS AND Y-AXIS MOTORS
S9
MOVE CUTTER TO CUT START POINT OF PATTERN BY DRIVING X-AXIS AND Y-AXIS MOTORS
S10
CUT START POINT?
NO
YES
S11
LOWER CUTTER BY DRIVING Z-AXIS MOTOR AND START CUTTING BY DRIVING X-AXIS AND Y-AXIS MOTORS
S12
SAVE CUT COUNT AND CORRESPONDING COUNT VALUE
S13
CUTTING OF EVERY PATTERN COMPLETED?
NO
YES
S14
LIFT CUTTER BY DRIVING Z-AXIS MOTOR
END

FIG. 11

CUTTING PLOTTER AND NON-TRANSITORY COMPUTER-READABLE STORAGE MEDIUM

CROSS-REFERENCE TO RELATED APPLICATION(S)

This application is based upon and claims the benefit of priority from the prior Japanese Patent Application 2012-071476, filed on, Mar. 27, 2012, the entire contents of which are incorporated herein by reference.

FIELD

The present disclosure relates to a cutting plotter that cut a desirable pattern from a cutting object and a non-transitory computer-readable medium storing a control program of the cutting plotter.

BACKGROUND

Conventionally, a cutting plotter that automatically cuts a sheet, e.g., a paper, has been known. The sheet is to be adhered to a base member which is an example of a holding member. An adhesive layer is provided on a surface of the base member. The cutting plotter pinches both side edges of the base member in an up-down direction by a driving roller and a pinch roller of a driving mechanism, and move the base member in a first direction. The cutting plotter moves a carriage that includes a cutter in a second direction perpendicular to the first direction. A desirable pattern is cut from the sheet by relative movements between the base member and the cutter.

After finishing the cut of the pattern, the cutting plotter moves the base member to the first direction by the driving roller and the pinch roller, and ejects the base member therefrom. The pattern cut from the sheet and residuals of the sheet are removed manually from the base member by a user. If another pattern is cut sequentially, a new sheet is adhered to the base member. The base member is used iteratively.

SUMMARY

In the cutting plotter described above, when the sheet is cut, a tip of the cutter penetrates the sheet and reaches the surface of the base member. Scratches made by the cutter remain on the base member. Thus, the scratches accumulate in the base member as the base member is used iteratively. The accumulated scratches may gradually prevent the sheet from being cut smoothly. The adhesive force of the base member gradually decreases; the base member would lose a substantial adhesive force to hold the sheet. Since the base member is a consumable item having a finite number of times that the sheet endures being used, it has been desired to increase the number of times that the sheet endures being used as possible.

A purpose of the present disclosure is to provide a cutting plotter that can prevent a performance of the base member from deteriorating in accordance with increasing a number of times that the base member is used and a non-transitory computer-readable medium storing a control program of the cutting plotter.

An aspect of the present disclosure may provide a cutting plotter including a processor and a memory. The memory stores computer-readable instructions. The instructions, when executed by the processor, cause the processor to perform setting, counting, storing, and notifying. The setting sets a plurality of partial areas by dividing a cuttable area of a holding member, the cuttable area is an area in which a cutting object is to be detachably adhered. The counting counts a number of cuts by a cutting blade within the cuttable area for each of the plurality of partial areas. The storing stores each of count values associated with each of the plurality of partial areas in a storage portion, each of the count values is counted by the counting for each of the plurality of partial areas. The notifying notifies, based on the count values stored in the storage portion, information relating to the number of cuts for each of the plurality of partial areas.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is one example of a perspective view illustrating the inner structure of a cutting apparatus.

FIG. **2** is one example of a front view of the cutting apparatus.

FIGS. **3**A and **3**B are examples of a front view and a plan view of a carriage and a cutter holder.

FIG. **3**C is an example of a cross sectional view taken along line IIIc-IIIc of FIG. **3**B.

FIG. **4** is one example of an enlarged view showing the portion near the tip of a cutter when a cutting operation is ongoing.

FIG. **5**A is one example of a plan view of a holding sheet.

FIG. **5**B illustrates one example of a correlation between a cuttable area shown on a display and the holding sheet illustrated in FIG. **5**A.

FIG. **6** is one example of a block diagram schematically illustrating an electric configuration.

FIG. **7**A is one schematic example of a data structure of cut data of a given pattern.

FIG. **7**B is one example of a diagram for explaining the cut data of the pattern.

FIG. **8** is one example of a chart for explaining a number of cuts represented as cut count stored for each of multiple partial areas.

FIG. **9** is one example of cut history screen.

FIG. **10** is one example of a workpiece, having been subjected to a cutting operation, shown with the holding sheet.

FIG. **11** is a flowchart indicating one example of a process flow for counting the number of cuts and displaying the obtained count during the cutting operation.

DETAILED DESCRIPTION

One configuration of the present disclosure is described with reference to FIGS. **1** to **11**.

Referring to FIG. **1**, the cutting apparatus **1** is provided with a main cover **2** serving as a housing, a platen **3** disposed inside the main cover **2**, and a cutter holder **5** holding a cutter **4** shown in FIG. **3**C. The cutting apparatus **1** is further provided with a carriage **20** supporting the cutter holder **5**, and a first transfer unit **7** and a second transfer unit **8** for allowing relative movement of the cutter **4** and a workpiece **6**.

The main cover **2** is shaped like a laterally elongate rectangular box. On the front face of the main cover **2**, a laterally elongate opening **2***a* is formed. Through the opening **2***a*, a holding sheet **10** holding a workpiece **6** may be placed on the upper surface of the platen **3**. In the following description, the direction in which a user positions him/herself relative to the cutting apparatus **1** is referred to as the forward direction and the direction opposite the forward direction as the rearward direction. The forward and rearward direction is also referred to as a Y direction and the direction orthogonal to the Y direction is referred to as an X direction.

Provided on the right side of the main cover **2** is a liquid crystal color display which is capable of displaying in full color and which is hereinafter referred to as display **9***a* for simplicity. Display **9***a* serves a display unit that presents images of various patterns and messages addressed to the user. Provided further on the right side of the main cover **2** is a plurality of control switches **9***b* shown in FIG. **6** which is controlled by the user for providing various instructions and making selections and inputs. For example, the user may select a given pattern from those presented on the display **9***a* and specify various parameters as well as input instructions for execution of various functionalities through the operation of the control switches **9***b*.

The platen **3** comprises a pair of front plate **3***a* and a rear plate **3***b* and the upper surface of the platen **3** exhibits a substantially horizontal plane which is hereinafter also referred to as an XY plane. The platen **3** is configured to receive the underside of holding sheet **10** when cutting the workpiece **6**. The upper surface of the holding sheet **10** includes an adhesive layer **10***v* shown in FIGS. **4** and **5**A which is formed by applying an adhesive on the area of the upper surface surrounded by peripheral edge portions **101** to **104**. The user may stick or attach the workpiece **6** on the adhesive layer **10***v* to allow the workpiece **6** to be held by the holding sheet **10**.

The first transfer unit **7** transfers the holding sheet **10** in the Y direction also referred to as a first direction across the upper surface of the platen **3** and is configured as described below. Inside the main cover **2**, sidewalls **11***a* and **11***b* are provided so as to be located on the left and right sides of the platen **3**. A drive roller **12** and a pinch roller **13** extend in the left and right direction across the sidewalls **11***a* and **11***b* so as to be located between the front plate **3***a* and the rear plate **3***b* of the platen **3**. The drive roller **12** and the pinch roller **13** are supported by the sidewalls **11***a* and **11***b* so as to be rotatable with respect to the sidewalls **11***a* and **11***b*. The drive roller **12** and the pinch roller **13** extend along a plane parallel with the XY plane and the pinch roller **13** is disposed above the drive roller **12**. Referring to FIG. **2**, on the outer surface of the right sidewall **11***b*, a first mount plate **19** is attached so as to be located rearward relative to the right end of the drive roller **12**. The first mount plate **14** is shaped like a crank and a Y-axis motor **15** is secured on the inner side of the first mount plate **14**.

The Y-axis motor **15** comprises, for instance, a stepper motor which is also known as a pulse motor. A rotary shaft **15***a* of the Y-axis motor **15** penetrates through the first mount plate **14** and at the end of the rotary shaft **15***a*, a drive gear **16***a* is attached. The drive gear **16***a* is meshed with a follower gear **16***b* provided on the right end of the drive roller **12**. The drive gear **16***a* and the follower gear **16***b* constitute a first deceleration gear mechanism **16**.

On the left side of the Y-axis motor **15**, a Y-axis encoder **67** is provided which is shown in FIG. **6** and later described. On each of the left and right sidewalls **11***a* and **11***b*, spring mounts **17***a* and **17***b* are provided respectively so as to cover the left and right ends of the pinch roller **13**. Further, on the outer surface of each of the left and right sidewalls **11***a* and **11***b*, spring mounts **18***a* are provided respectively so as to protrude from the outer surface of sidewalls **11***a* and **11***b*. Only the left side spring mount **18***a* is shown in FIG. **1**. Coil springs **19***a* and **19***b* are mounted on the spring mounts **17***a* and **17***b* and the spring mounts **18***a* and **18***b*, so as to be extend between the spring mounts **17***a* and **17***b* and the spring mounts **18***a* and **18***b*. Thus, the pinch roller **13** is constantly biased downward by the coil springs **19***a* and **19***b*. Near the left and right side ends of the pinch roller **13** proximal to the sidewalls **11***a* and **11***b*, a pair of left and right depressors **13***a* and **13***b* is provided that have outer diameters slightly larger than those of other portions of the pinch roller **13**. The depressors **13***a* and **13***b* of the pinch roller **13** contact and depress the left and right side edge portions **101** and **102** of the holding sheet **10**. The drive roller **12** similarly has depressors **12***a* and **12***b* at locations corresponding to the depressors **13***a* and **13***b*. The carriage **20** supporting the cutter holder **5** moves along the portion of pinch roller **13** located between depressors **13***a* and **13***b*.

The holding sheet **10** is held between the overlying pinch roller **13** and the underlying drive roller **12** so as to be depressed by the elasticity of the coil springs **19***a* and **19***b* and the weight of components such as the carriage **20**. The forward/reverse rotation of the Y-axis motor **15** is transmitted to the drive roller **12** by way of the first deceleration gear mechanism **16** to feed the holding sheet **10** as well as the workpiece **6** rearward or forward. The components such as the drive roller **12**, the pinch roller **13**, the Y-axis motor **15**, the first deceleration gear mechanism **16**, and the coil springs **19***a* and **19***b* constitute the first transfer unit **7**.

The second transfer unit **8** transfers the carriage **20** as well as the cutter holder **5** in the X direction also referred to as the second direction. More specifically, between the upper end portions of the left and right sidewalls **11***a* and **11***b*, a guide shaft **21** is disposed so as to extend in the left and right direction as can be seen in FIGS. **1** and **2**. The guide shaft **21** is disposed so as to be parallel with the drive roller **12** and the pinch roller **13**. The guide shaft **21** extends through the upper portion of the carriage **20**, that is, through a later described insert hole **22**. The carriage **20** is thus allowed to slide along the guide shaft **21** so as to be guided by the guide shaft **21**.

Still referring to FIGS. **1** and **2**, on the rear portion of cutting apparatus **1**, and more specifically on the left sidewall **11***a*, an L-shaped second mount frame **24** is provided. Disposed on the second mount frame **24** is an X-axis motor **26** and a second deceleration gear **27**. The X-axis motor **26** comprises, for example, a stepper motor. The X-axis motor **26** is secured on the underside of the second mount frame **24**. As shown in FIG. **1**, a rotary shaft **26***a* of the X-axis motor **26** extends through the second mount frame **24** and has drive gear **27***a* attached to its tip. The drive gear **27***a* meshes with a follower gear **27***b* located in front of it. The follower gear **27***b* is supported rotatably by the second mount frame **24**. The drive gear **27***a* and follower gear **27***b* constitute the second deceleration gear mechanism **27**. On the upper surface of the follower gear **27***b*, a pulley **28** is provided which rotates integrally with the follower gear **27***b*. Below the X-axis motor **26**, an X-axis encoder **68** is provided which will be later described. On the right side upper surface of the first mount plate **14** as viewed in FIG. **2**, a pulley **29** is mounted rotatably. The timing pulleys **28** and **29** are wound with an endless timing belt **31**. The endless timing belt **31** is connected to a later described mount portion **30** shown in FIG. **3**B located on rear portion of the carriage **20**.

When the X-axis motor **26** is driven in rotation in the forward and reverse directions, the rotary motion is transmitted to the timing belt **31** by way of the second deceleration gear mechanism **27** and the pulley **28**. As a result, the carriage **20** as well as the cutter holder **5** are transferred in the left and right direction. The carriage **20** and the cutter holder **5** are thus, transferred in the X direction which is orthogonal to the Y direction in which the workpiece **6** is fed. The components such as the guide shaft **21**, the X-axis motor **26**, the second deceleration gear mechanism **27**, the pulley **28**, the pulley **29**, the timing belt **31**, and the carriage **20** constitute the second transfer unit **8**.

The cutter holder **5** is disposed on the front side of the carriage **20** and is supported by the carriage **20** so as to be movable in the up and down direction, also referred to as the Z direction or a third direction. As shown in FIGS. **3**A and **3**B, the carriage **20** is provided with a front wall **20***c* which is substantially rectangular. The upper end portion and the lower end portion of the front wall **20***c* are bent reward to define an upper edge **20***a* and a lower edge **20***b* of the carriage **20**. On the upper edge **20***a* of the carriage **20**, a pair of left and right projections is formed so as to protrude upward. The left and right projections are each provided with an insert hole **22** through which the guide shaft **21** is inserted. On the lower edge **20***b* of the carriage **20**, guide subject **23** is provided so as to be structurally integral with the lower edge **20***b*. The guide subject **23** extends in the left and right direction and has a substantially U-shaped cross section in which the opening of the U-shape faces downward. The guide subject **23** is engaged with the pinch roller **13** so as to be slidable in the left and right direction along the pinch roller **13** and such that the guide subject **23** is located above the pinch roller **13**. Further, the front wall **20***c* of the carriage **20** is provided with the mount portion **30** described earlier that protrudes rearward. The mount portion **30** is connected to the timing belt **31**. The carriage **20** is supported slidably in the left and right direction by the guide shaft **21** inserted through the insert holes **22**. The carriage **20** is inhibited from pivoting about the guide shaft **21** by the slidable engagement between the guide subject **23** and the pinch roller **13**.

Referring to FIG. **3**B, a first engagement portion **32***a* and a second engagement portion **32***b* are provided on the front wall **20***c* of the carriage **20**. The first engagement portion **32***a* and the second engagement portion **32***b* extend in the up and down direction on the front wall **20***c*. The first engagement portion **32***a* and the second engagement portion **32***b* engage with a later described first engagement subject **33***a* and a second engagement subject **33***b* of cutter holder **5**.

As shown in FIG. **1** and FIG. **3**B, etc., a third mount frame **35** formed into a crank shape is provided on the left side portion of the front wall **20***c* of the carriage **20**. The Z-axis motor **39** and a third deceleration gear mechanism **36** are disposed on the third mount frame **35**. The Z-axis motor **34** comprises, for example, a stepper motor. The z-axis motor **34** is secured on the front face of a mount piece **35***a* disposed on the front side of the third mount frame **35**. As shown in FIG. **3**B, a rotary shaft **34***a* of the Z axis motor **34** penetrates through the mount piece **35***a*. On the tip of the rotary shaft **34***a* of the Z-axis motor **34**, a drive gear **34***b* is attached. The third mount frame **35** is further provided with amount piece **35***b* on its rear side and a gear shaft **37** protrudes forward from the mount piece **35***b*. An intermediate gear **38** and a pinion **39** are mounted rotatably on the gear shaft **37**. The pinion **39** is relatively smaller in diameter as compared to the intermediate gear **38**. A stop ring **40** is secured on the front end of the gear shaft **37** to prevent the dislocation of the gear shaft **37**. The intermediate gear **38** meshes with the drive gear **34***b*. The pinion **39** and the intermediate gear **38** are structurally integral. The drive gear **34***b*, the intermediate gear **38**, and the pinion **39** constitute the third deceleration gear mechanism **36**.

As shown in FIGS. **3**A to **3**C, a holder body **43** of the cutter holder **5** is provided with a shaft container **44** and a cylindrical portion **45** that are structurally integral with the holder body **43**. The shaft container **44** constitutes the left side half of the holder body **43** whereas the cylindrical portion **45**, being stepped down relative to the shaft container **44**, constitutes the right side half of the cylindrical body **43**. The shaft container **44** extends in the up and down direction. As shown in FIG. **3**B, the first engagement subject **33***a* is provided on a rear side wall of the shaft container **44** and the second engagement subject **33***b* is provided on a rear sidewall of the cylindrical portion **45**. The holder body **43** is assembled with the carriage **20** so as to lower the holder body **43** into engagement with the carriage **20** while placing the first engagement subject **33***a* in engagement with the first engagement portion **32***a* and the second engagement subject **33***b* in engagement with the second engagement portion **32***b*, respectively. Thus, the holder body **43** is supported by the carriage **20** so as to be movable in the up and down direction relative to the carriage **20**.

Referring to FIG. **3**C, the shaft container **44** of the holder body **43** is provided with a mount shaft **48**. The mount shaft **48** extends in the up and down direction through a bottom wall **44***a* and an upper wall **44***b* of the shaft container **44**. The mount shaft **48** is provided with a pair of upper and lower stop rings **49** that are disposed so as to hold the lower wall **44***a* and the upper wall **44***b* therebetween. The mount shaft **48** is secured to the holder body **43** by the stop rings **49**. On the left side of the mount shaft **48**, a rack forming member **41** is disposed. The rack forming member **41** is provided with a rack **41***a* and a pair of mount pieces **41***b* and **41***c* extending rightward from the rack **41***a*. The rack **41***a* and the pair of mount pieces **41***b* and **41***c* are structurally integral with the rack forming member **41**. Rack **41***a* extends in the up and down direction along the mount shaft **48**. The rack **41***a* meshes with the pinion **39** of the third deceleration gear mechanism **36**. The pair of mount pieces **41***b* and **41***c* extends rightward from the upper end portion and the mid portion of the rack **41***a* respectively.

The rack forming member **41** is mounted on the mount shaft **48** extending through the mount pieces **41***b* and **41***c* so as to be movable in the axial direction of the mount shaft **48**. The rack forming member **41** is disposed such that mount piece **41***c* provided on its mid portion is located below the upper wall **44***b*. Further, compression coil spring **50** is wound on the portion of mount shaft **48** located between mount piece **41***c* of the rack forming member **41** and the bottom wall **44***a* of the shaft container **44**.

The rack **41***a* of the rack forming member **41** meshes with the pinion **39** of the third deceleration gear mechanism **36**. Thus, when the Z-axis motor **34** is driven in the forward or reverse directions, the drive force is transmitted to the rack forming member **41** by way of the drive gear **34***b*, the intermediate gear **38**, and the pinion **39**. Thus, the holder body **43** and consequently the cutter holder **5** are moved between the lowered position and the lifted position. When the cutter holder **5** is in the lowered position, a blade **4***b* of the cutter **4** penetrates through the workpiece **6** as shown in FIG. **4**. When the cutter holder **5** is in the lifted position, the blade **4***b* is spaced apart from the workpiece **6** by a predetermined distance as shown in FIGS. **2**, **3**A, **3**C.

When the cutter holder **5** is in the lowered position, the compression coil spring **50** below the mount piece **41***c* of the rack forming member **41** becomes downwardly compressed. Thus, biasing force, in other words, the elasticity of the compression coil spring **50** exerts a predetermined pressure which is applied to the workpiece **6** by way of the cutter **4**. The compression coil spring **50** also allows the upward movement of the cutter holder **5** and consequently the cutter **4** against the biasing force. The components such as the third deceleration gear mechanism **36**, the Z-axis motor **34**, and the rack forming member **41** constitute a third transfer unit **42** that transfers the cutter holder **5** in the up and down direction. Thus, the cutter holder **5** is moved relative to the workpiece **6** by the first transfer unit **7**, the second transfer unit **8**, and the third transfer unit **42**.

The cutter holder **5** is provided with a support device **46** and a pressure device **47**. The support device **46** is disposed on the cylindrical portion of the holder body **43** and is configured to support the cutter **4** so as to be rotatable about the Z-axis. The pressure device **47** is configured to depress the workpiece **6**.

Referring to FIG. 3C, the support device **46** is provided with a support base member **51** which is substantially cylindrical and which is provided inside the cylindrical portion **45** of the holder body **43**. On the upper end portion of the support base member **51**, a flange **51***a* is formed. The flange **51***a* projects radially outward so as to be supported by the upper end of the cylindrical portion **45**. The support base member **51** is inserted into the cylindrical portion **45** from the upward direction and is fastened to the holder body **43** by a screw **52**. The screw **52** radially penetrates the cylindrical portion **45** at a location just above the mid portion of the cylindrical portion **45** to lock the support base member **51** in place.

In the lower end interior of the support base member **51**, a bearing member **54** is provided. In the upper half interior of the support base member **51**, a bearing portion **51***b* is formed so as to be structurally integral with the support base member **51**. The bearing portion **51***b* is in sliding contact with the outer peripheral surface of the cutter shaft **55** of the cutter **4**. The bearing member **54** and the bearing portion **51***b* constitute a bearing unit that rotatably supports the cutter **4** about its central axis **4***z*.

The cutter **4** comprises a cutter shaft **55** in the shape of round bar and the blade **4***a* formed at the lower end of the cutter shaft **55** that are structurally integral. As can be seen in FIG. **4**, the blade **4***b* is sharpened at an angle toward the workpiece **6**. The lowermost tip **4***a* of the blade **4***b* is eccentric by distance d from the central axis **4***z* of the cutter shaft **55**. The height of the cutter **4** is adjusted so that the blade **4***b* penetrates through the workpiece **6** and possibly into the underlying holding sheet **10** but does not reach the upper surface of the platen **3***b* when the cutter holder **5** is moved to the lowered position.

On the lower portion of the cutter **4** near the blade **4***b*, a support member **53** is provided which is shaped like a stepped cylinder as shown in FIG. 3C. The support member **53** has an insert hole **58** penetrating axially through its center. The support member **53** establishes a fitting engagement with the cutter **4** by pressing the cutter shaft **55** into the insert hole **58**

The upper end of the support member **53** is fitted into the bearing member **54**. Thus, the cutter **4** being fitted with the support member **53** is supported by the bearing member **54** and the bearing portion **51***b* so as to be rotatable with respect to the support base member **51**. On the outer peripheral side of the insert hole **58** of the support member **53**, a spring receiving groove **53** is provided. The spring receiving groove **53***a* is coaxial with the insert hole **58** and is formed so as to extend upward from the lower surface side of the support member **53**. The spring receiving groove **53***a* receives the upper half of a compression coil spring **60** later described. The support base member **51**, the bearing member **54**, and the support member **53** constitute the support device **46** that supports the cutter **4** rotatably about the central axis **4***z*.

The pressure device **47** is provided with a presser member **61** and a compression coil spring **60**. The presser member **61** is configured to depress the workpiece **6** and is made of resin material. The compression coil spring **60** elastically biases the presser member **61** toward the workpiece **6**.

The presser member **61** is formed as a cylindrical container with an enclosed bottom and is configured to receive the lower portion of the support member **53**. The bottom central portion of the presser member **61** protrudes downward to serves as a contact portion **63**. The bottom surface of the contact portion **63** is a round planar surface lying on a horizontal plane. The bottom surface of the contact portion **63** is configured to establish surface contact with the workpiece **6**. As shown in FIG. **4**, the contact portion **63** has a through hole **63***a* extending through it in the up and down direction. The through hole **63***a* is dimensioned so as to be slightly larger than the cross section of the cutter **4** to allow the smooth insertion of the blade **4***b* into the through hole **63***a*.

As shown in FIG. 3C, the compression coil spring **60** is disposed between the upper portion of the presser member **61** and the spring receiving groove **53***a* of the support member **53**. The presser member **61** is provided with a lock portion not shown that prevents the disengagement of the support member **53**. The presser member **61** and the coil spring **60** are attached to the support member **63** from the lower side. Thus, when the cutter holder **5** is in the lifted position, the cutter **4** is stored inside the presser member **61** such that the blade **4***b* is not exposed as shown in FIGS. **3**A and **3**C. In contrast, when the cutter holder **5** is in the lowered position, the presser member **61** is biased toward the workpiece **6** by the compression coil spring **60** to depress the workpiece **6** with a predetermined biasing force.

Next, a description will be given on the holding sheet **10** with reference to FIG. **5**A. The holding sheet **10** comprises a holding member made of materials such as resin and is substantially rectangular. The holding sheet **10** is provided with an adhesive layer **10***v* on its upper surface opposing the cutter **4** as shown in FIG. **4**. The adhesive layer **10***v* is formed in an area within the holding sheet **10** which is spaced inward by a predetermined distance, indicated as W**1** and W**2** in FIG. **5**A, from the outer edge of the holding sheet **10**. As shown in FIG. **5**A, the adhesive layer **10***v* is substantially rectangular in plan view and comprises a transparent adhesive material removably holding various types of workpiece **6**. The adhesive force of the adhesive layer **10***v* is controlled to a relatively weak level to allow the workpiece **6** to peel easily without ripping. The workpiece **6**, when being cut by the cutting apparatus **1**, is held unmovably with respect to the holding sheet **10** by the adhesive force of the adhesive layer **10***v* and the pressure applied by the presser member **61**.

On the peripheral edge of the holding sheet **10**, a left edge portion **101**, a right edge portion **102**, a rear edge portion **103**, and a front edge portion **104** are provided as areas free of the adhesive layer **10***v*. The left edge portion **101** and the right edge portion **102** each serves as a support subject portion being supported by the pressure applied by the underlying depressors **12***a* and **12***b* of the drive roller **12** and the overlying depressors **13***a* and **13***b* of the pinch roller **13**. The holding sheet **10** is provided with base line **65** that delineates the area occupied by the adhesive layer **10**. Base line **65** comprises a first base line **65***a* and second base line **65***b* shown in FIG. **5**A. The first base line **65***a* is shaped as a rectangular frame outlining the outer edge of the adhesive layer **10***a*. The second base line **65***b* delineates the adhesive layer **10***v* into partitions of a predetermined sized. These base lines **65***a* and **65***b* may be printed on the upper surface of the holding sheet **10**. The base lines **65***a* and **65***b* can be seen through the transparent adhesive layer **10***v*.

The area occupied by the adhesive layer **10***v* is defined as a cuttable area. The cuttable area is divided into n number of areas counted in the front and rear direction and into m number of areas counted in the left and right direction. Thus, the cuttable area is delineated into n×m number of areas identified as (1, 1) partial area to (n, m) partial area. In the example shown in FIG. **5**A, the second base line **65***b* divides the inner bounds of the first base line **65***a*, that is, the area occupied by the adhesive layer **10***v* into 5 areas in the front and rear direction and into 3 areas in the left and right direction in equal spacing. The 15 partial areas thus formed are identified as (1, 1) partial area to (5, 3) partial area as shown in FIG. **5**B. The partial areas (1, 1) to (5, 3) are each identical in shape and size. The base line **65** forms a lattice partition pattern on the holding sheet **10** in the above described example. Hence, the base line **65** serves as a reference in the location and the size of the workpiece **6** to be attached to the adhesive layer **10***v*. The shape and the partition pattern of the holding sheet **10** are not limited to the shown shape and pattern but may be formed into any given pattern or shape to divide the cuttable area.

The cutting apparatus **1** is provided with a detection sensor **66** shown in FIG. **6** that detects the holding sheet **10** set through the opening **2***a*. The cutting apparatus **1** is further provided with a control circuit **71** which assigns origin (X0, Y0) to point "O" of the set holding sheet **10** shown in FIG. **5**A based on the detection signal of the detection sensor **66**. Thus, the cutting apparatus **1** defines an X-Y coordinate system based on origin O of the holding sheet **10**. The cutting apparatus **1** moves the cutter **4** and the workpiece **6** relative to one another on the X-Y coordinate system through control of the Y-axis motor **15** of the first transfer unit **7** and the X-axis motor **26** of the second transfer unit **8** based on the later described cut data. As indicated in FIG. **5**B, the coordinate system of the cutting apparatus **1** is configured such that the X-axis extends from the left to right starting from the origin O located on the upper left corner of the holding sheet **10**, whereas the Y-axis extends from the rear side to the front side starting from the origin O. Thus, the X-axis value increases toward the right side of the holding sheet **10** and the Y-axis value increases toward the front side of the holding sheet.

The coordinate indicating the current position of the cutter **4** is calculated based on the detection signals of the X-axis encoder **68** and the Y-axis encoder **67**. The X-axis encoder **68** and the Y-axis encoder **67** are ordinary encoders known in the art and thus will not be described in detail. The X-axis encoder **68** detects the amount of rotation and the direction of rotation of the X-axis motor **26**, whereas the Y-axis encoder **67** detects the amount of rotation and the direction of rotation of the Y-axis motor **15**. The detection signals of the X-axis encoder **68** and the Y-axis encoder **67** are outputted to the control circuit **71**. Based on the detection signals, the control circuit **71** calculates the amount of X-directional movement of the cutter **4** by the second transfer unit **8** and the amount of Y-directional movement of the holding sheet **10** by the first transfer unit **7**.

The control circuit **71** thus, calculates the coordinate indicating the current location of the cutter **4** on the holding sheet **10** as well as controlling the motors **15** and **26** while monitoring the X-directional and the Y-directional movement of the cutter **4**. In the present configuration, the motors **15** and **26** employ a stepper motor also known as a pulse motor. Thus, the current location of the cutter **4** may be detected based on the pulse count of drive pulse given to the motors **15** and **26** as command values. Such arrangement allows the encoders **67** and **68** to be eliminated and thus, simplifies the overall configuration.

Next, a description will be given on a control system of the cutting apparatus **1** with reference to the block diagram illustrated in FIG. **6**.

The control circuit **71** responsible for the overall control of the cutting apparatus **1** is primarily configured by a computer (CPU) and is coupled to a ROM **72**, RAM **73**, EEPROM **74**, and an external memory **75**. ROM **72** stores various types of computer programs such as a cut control program for controlling the cut operation executed by the cutting apparatus **1** and a control program for controlling the image output through display **9***a*. The RAM **73** is a temporary storage for storing data and programs used in executing various processes. External memory **75** stores cut data used in the cutting patterns with the cutting apparatus **1**. As will be later described in detail, EEPROM **74** stores number of cuts made in a pattern for each partial area.

The control circuit **71** is connected to various control switches **9***b*, detection sensor **66**. The controller **71** is further connected to the display **9***a* by way of drive circuit **79**. The display **9***a* outputs various items such as a later described pattern selection screen not shown and a cut history screen shown in FIG. **9**. The user may select a desired pattern, etc. through the operation of various control switches **9***b* while viewing the display **9***a*. The control circuit **71** is further connected to drive circuits **76**, **77**, and **78** for driving the Y-axis motor **15**, the X-axis motor **26**, and the Z-axis motor **34**, respectively. The control circuit **71** controls the Y-axis motor **15**, the X-axis motor **26**, and the Z-axis motor **34** through the execution of the cut control program to automatically execute the cutting of the workpiece **6** located on the holding sheet **10**.

The cut data stored in the external memory **64** includes basic size information, cut line data, and display data. The basic size information contains the longitudinal and latitudinal sizes of a pattern and is represented as a virtual rectangular frame data that surrounds the pattern. For example, in pattern S depicting a "star" in FIG. **7**B, the basic size information is represented by the size of rectangular frame F surrounding the pattern so as to contact vertexes P_0 to P_{10}.

The cut line data comprises coordinate data indicating the vertexes of the cut line comprising multiple line segments located in the XY coordinate system. In the example shown in FIG. **7**B, the cut line of pattern S comprises line segments **S1** to **S10**. The cut line, formulated by the line segments **S1** to **S10**, exhibits a closed star shape in which a cut start point P_0 and a cut endpoint P_{10} are coincidental. The cut line data of pattern S includes a first coordinate (X1, Y1), a second coordinate (X2, Y2), a third coordinate (X3, Y3), . . . , and eleventh coordinate data (X11, Y11) corresponding to cut start point P_0, vertex P_1, vertex P_2, vertex P_3, . . . , cut end point P_{10}. The coordinates are plotted, for example, based on a coordinate origin W_0 located at the upper left corner of rectangular frame F shown in FIG. **7**B. Coordinate origin W_0 is associated with origin O of the holding sheet **10** and the cutting operation is performed based on the cut line data.

When cutting pattern S by the cutting apparatus **1**, the cutter **4** is relatively moved to the XY coordinate representing the cut start point P_0 of pattern S. The relative movement of the cutter **4** is achieved by the Y-directional movement of the holding sheet **10** and consequently the workpiece **6** by driving the Y-axis motor **15** and by the X-directional movement of the cutter holder **5** by driving the X-axis motor **26**. Then, the blade **4***b* of the cutter **4** is pierced through cut start point P_0 located on the workpiece **6**. Then, the cutter **4** is relatively moved toward the end point P_1 of line segment **S1** by the Y-axis motor **15** and the X-axis motor **26** to cut the workpiece **6** along line segment **S1**. The cutting of the subsequent line segment **S2** starts from the end point P_1 of the preceding line segment **S1** and proceeds continuously in the same manner. The cutting of segments **S2** to **10** proceeds continuously in sequence to cut along the cut lines of pattern S, i.e. the "star" based on the cut line data.

In the present configuration, the number of cuts made by the cutter **4** on a pattern within the cuttable area of the holding sheet **10** is counted for each partial area. The "cuttable area" is an area in which the workpiece **6** attached to the adhesive layer **10***v* of the holding sheet **10** is cuttable. The cutting apparatus **1** also defines the cuttable area as a collection of multiple subdivided partial areas.

The rectangular area illustrated in FIG. **5**B represents cuttable area A which is outputted on display **9***a*. EEPROM **74** stores partial area information that identifies each of the partial areas. More specifically, the partial area information is configured by line segment data of base lines L**0**, L**1**, L**2**, and L**3** extending longitudinally in FIG. **5**B and line segment data of base lines L**00**, L**10**, L**20**, L**30**, L**40**, and L**50** extending laterally in FIG. **5**B. The foregoing line segments are associated with base line **65** of the holding sheet **10**. Alternatively, the line segment data may be configured by coordinate data plotted at the intersection of base lines L**0** to L**3** and base lines L**00** to L**50**, in other words, the coordinates plotted at the 4 corners of each of (1, 1) partial area to (5, 3) partial area. The partial area information is arranged based on coordinate origin OL corresponding to origin O of the holding sheet **10**. The partial area information also contains data for displaying purposes.

Thus, (1, 1) partial area to (5, 3) partial area on the holding sheet **10** are represented by coordinates associated with base lines L**0** to L**3** and L**00** to L**50** that delineate cuttable area A. Further, (1, 1) partial area to (5, 3) partial area are defined by the coordinate system of the cutting apparatus **1** based on origin O of the holding sheet **10**. The partial area information may vary the number of partitions of cuttable area A depending upon the number of partitions given by n×m. Cuttable area A is shown in the appropriate size as shown FIG. **9**.

Referring to FIG. **8**, number of cuts made on the pattern in (1, 1) partial area to (5, 3) partial area are indicated as cut counts cnt**1** to cnt**15**. More specifically, control circuit **71** calculates the coordinate of the current location of the cutter **4** based on the detection signals of the encoders **67** and **68** during the cutting of the pattern. At this instance, the control circuit **71** refers to the partial area information associated with the coordinate of the current location of the cutter **4**. Thus, the control circuit **71** increments the cut count cnt**1** by 1 when judging that cutting of pattern S is performed on pattern S in (1, 1) partial area. As described above, cut counts cnt**1** to cnt**15** are counted by the control circuit **71** for each of the partial areas associated with (1, 1) partial area to (5, 3) partial area. The counted cut counts cnt**1** to cnt**15** are stored in EEPROM **74** as cumulative values for each partial area. Further, information pertaining to cut counts cnt**1** to cnt**15** is outputted on the screen shown on display **9***a* along with (1, 1) partial area to (5, 3) partial area within cuttable area A. The information pertaining to cut counts cnt**1** to cnt**15** provides a reference to the user in specifying the location in which the pattern is to be cut. More specifically, as will be later described in the working of the foregoing configuration, the control circuit **71** verifies cut counts cnt**1** to cnt**15** and identifies or specifies a specific partial area within cuttable area A which is preferable or recommended for cutting the pattern. The recommended area is highlighted in a color distinguished from the color of other areas within the cut history screen as illustrated in FIG. **9**. Thus, the user is informed of the preferable location within the holding sheet **10** for cutting the workplace **6**.

The above described control circuit **71** is one example of a counting unit that counts the number of cuts made on the pattern, i.e. cut counts cnt**1** to cnt**15** for each of the partial areas. EEPROM **74** is one example of a nonvolatile storage that stores the counts with a mapping to each of the partial areas. The control circuit **71**, display **9***a*, and drive circuit **79** are examples of a notifying unit and a display unit that notifies information pertaining to the cut count for each of the partial areas.

Next, a description will be given on the working of the above described configuration with reference to FIG. **11**.

The flowchart of FIG. **11** indicates the process flow of a control program executed by the control circuit **71**.

The process of control program starts by turning on the power of the cutting apparatus **1**. By the user operation of the control switches **9***b*, a pattern selection screen not shown is outputted/displayed on the display **9***a* for pattern selection. The user is to select the desired pattern, which, in this example is pattern S representing a “star” by operating the control switches **9***b* (step S**1**). As a result, cut data of the selected pattern S is read from the external memory **75** and loaded into the RAM **73**.

The display **9***a* outputs an input screen not shown for making inputs pertaining to the holding sheet **10**. The input screen **10** presents selection of items pertaining to the holding sheet **10** such as “USE NEW SHEET” and “REUSE USED SHEET”. The user is to make the applicable selection based on the status of the holding sheet **10** at hand.

Supposing that the control circuit **71** made a judgment that the holding sheet **10** is not new, i.e. not in is mint condition, based on the input made pertaining to the holding sheet **10** (step S**2**: NO), the control circuit **71** proceeds to verify cut counts cnt**1** to cnt**15** stored in the EEPROM **79**. Then, based on the result of the verification, the controller **71** identifies the partial area having the least cut count within cuttable area A as the recommended area in which the cutting of pattern S is recommended. For example, if the cut count cnt**11** of (4, 2) partial area indicated in FIGS. **5**B and **8** is less than the cut counts cnt**1** to cnt**10** and cnt**12** to cnt**15** of other partial areas, (9, 2) partial area is identified as the recommended area.

Then, the identified (4, 2) partial area is notified by outputting the cut history screen as exemplified in FIG. **9** (step S**3**). The cut history screen displays the (1, 1) partial area to (5, 3) partial area constituting the cuttable area A in the appropriate size. (1, 1) partial area to (5, 3) partial area are partial areas defined by delineating cuttable area A by the base lines L**0** to L**3** and L**00** to L**50** corresponding to the base **65** of the holding sheet **10**. (4, 2) partial area within the cuttable area A is colored distinctly from other partial areas on the display **9***a*. Thus, (9, 2) partial area is readily distinguishable as an area having the least number of cuts, meaning that cut count cnt **11** is the least among other cut counts. The above described configuration allows the user to find the area in which pattern S should be cut within the holding sheet **10** at a glance. In case the holding sheet **10** at hand is new (step **82**: YES), cut counts cnt**1** to cnt**15** stored in the EEPROM **74** are completely initialized (step S**4**). When initialized, “0” is assigned to all of cut counts cnt **1** to cnt **15**.

Next, the user is to attach the workpiece **6** which may be various types of sheet materials such as paper, cloth, and resin film onto the adhesive layer **10***v* of the holding sheet **10**. The workpiece **6** may come in a size that covers the entire area of the adhesive layer **10***v* as shown in FIG. **1**. Alternatively, workpiece **6** suitably sized with pattern S may be attached to (4, 2) partial area as shown in FIG. **10**. Then, the holding sheet **10** holding the workpiece **6** is inserted into the opening **2***a* of the cutting apparatus **1** and instructions are given through the operation of the controls switches **9***b* to “SET” the holding sheet **10** for execution of the cutting operation. The control circuit **71** responsively feeds the holding sheet **10** rearward by driving the Y-axis motor **15** and origin O is specified to the holding sheet (step S**5**) based on the detection signal outputted by the detection sensor **66** as the result of detection performed on the holding sheet **10**.

The display **9***a* outputs a partial area selection screen not shown for selecting the location for cutting pattern S. The partial area selection screen shows cuttable area A corresponding to the base line **65** located on the holding sheet **10** and being suitably sized as was the case in the cut history screen. Area identification numbers such as (1, 1) to (5, 3) associated with each of the partial areas may also be presented in the cuttable area A shown in the display **9***a*. Then, the user is to specify the area identification number (step S**6**) associated with (4, 2) partial area from the area identification numbers (1, 1) to (5, 3) by operating the control switch **9***b* while viewing the partial area selection screen. The control circuit **71** designates the location of pattern S with respect to the workpiece **6** such that the designated location corresponds to the specified (4, 2) partial area. Based on the partial area information, the control circuit **71** modifies the coordinates of the cut data so that the virtual rectangular frame F of pattern S is contained within (4, 2) partial area. Then, the control circuit **71** stores the modified coordinates in the RAM **73**.

Then, instruction for staring the cutting operation is given by the user operation of the control switches **6***b* (step S**7**: YES). The control circuit **71** begins the cutting operation by driving the Y-axis motor **15** and the X-axis motor **26** to return the cutter holder **5** to the origin. As a result, the blade **4***b* of the cutter **4** is located over origin O (step S**8**). Then, the Y-axis motor **15** and the X-axis motor **26** are driven to move the blade **4***b* of the cutter **4** to the cut start point P_0 of the workpiece **6** as shown in FIG. **7**B. The cutter **4** and the workpiece **6** are relatively moved in the X and Y directions with the cutter **4** and the workpiece **6** being spaced apart in the up and down direction (step S**9**).

The control circuit **71** calculates the coordinate of the cutter **4** and controls the drive of the Y-axis motor **15** and the X-axis motor **26** based on the detection signal of the X-axis and the Y-axis encoders **66** and **67**. The control circuit **71** moves the cutter holder **5** to the lowered position by driving the Z-axis motor **34** once the cutter **4** has been transferred to the cut start point P_0 (step S**10**: YES). As a result, the workpiece **6** is depressed by the contact portion **63** of the presser member **61** and the blade **4***b* of the cutter **4** is projected downward through the through hole **63***a* of the contact portion **63** to penetrate the cut start point P_0 the workpiece **6** as shown in FIG. **4**. Then, the Y-axis motor **15** and the X-axis motor **26** are driven to relatively move the cutter **4** toward the coordinate of the end point P_1 of line segment S**1** shown in FIG. **7**B to start cutting along the line segment S**1** (step S**11**).

When cutting of line segments S**1** and S**2** to S**10** of the cut line for pattern S is executed continuously in sequence, the number of cuts, i.e. cut count is counted for each of the partial areas. Control circuit **71** reads the preset partial area information from the EEPROM **74** and determines the partial area in which cuts were made based on the partial area information and the coordinate of the cutter **4**. Supposing that the control circuit **71** has made a judgment that cuts were made up to cut end point P_{10} on pattern S within (4, 2) partial area, the cut count cnt**11** associated with (4, 2) partial area is incremented by 1. Then the cut count cnt**11** stored in the EEPROM **74** is updated by being overwritten by the latest cut count cnt**11** after pattern S has been cut (step S**12**). After pattern S representing a “star” selected in step S**1** has been completely cut out (step S**13**: YES) as shown in FIG. **10**, the cutter holder **5** is moved to the lifted position. Then, the holding sheet **10** is fed forward and ejected to terminate the process.

In case one or more patterns were selected in addition to pattern S in step S**1**, a judgment is made at step S**13** that cutting of all the patterns have not been completed yet (S**13**: NO). Thus, in the subsequent step S**14**, the cutter holder **5** is moved to the lifted position by driving Z-axis motor **34** and the process returns to step S**9**. Then, steps S**9** to S**13** are executed for the remaining pattern(s). In case the remaining pattern is another “star” being formed in (4, 3) partial area adjacent to (4, 2) partial area in which pattern S was formed, cut count cnt**12** associated with (4, 3) partial area is incremented by 1 after the execution of step S**9** to S**13** and the updated cut count cnt**12** is stored in EEPROM **74**. Because control circuit **71** executes the controls of the cutting while monitoring the detection signals outputted from the encoders **67** and **68**, the partial area in which the cutting was performed can be determined reliably with accuracy.

As the cutting operation is repeated, scratches of the cutter **4** accumulate on the surface of the holding sheet **10** and thus, it becomes gradually difficult to cut the workpiece **6** neatly. The adhesiveness of the adhesive layer **10***v* also degrades with use and thus, it becomes gradually difficult to provide secure hold of the workpiece **6**. The holding sheet **10** is thus, a consumable which may be used up to 10 times for example. In the present configuration, the location for cutting pattern S on the workpiece **6** of the holding sheet **10** is arranged to correspond to the recommended area identified in step S**3**. The cutting of pattern S may be performed using the holding sheet holding a workpiece which covers the entire area of the adhesive layer **10***v* or a workpiece which is suitably sized with pattern S. Thus, scratches on the holding sheet **10** will no longer be localized and the localized degradation of adhesiveness can also be prevented, thereby allowing the holding sheet **10** to be used more number of times.

The above described step S**3** and step S**12** are examples of instructions for displaying or specifying a subdivided cuttable area of the workpiece **6** of the holding sheet **10**. Step S**12** is also one example of instructions for counting the number of cuts, i.e. cut count cnt of the pattern by the cutter **4** within the cuttable area for each partial area. Step S**12** is also one example of instructions for storing the count.

Step S**3** is also one example of instructions for notifying information pertaining to cut count cnt based on the count stored in the instructions for storing. Step S**3** is further one example of instructions for specifying a partial area as a recommended area in which cutting of the pattern is recommended. Still further, step S**3** is one example of instructions for displaying information pertaining to multiple partial areas within the cuttable area and information pertaining to cut count cnt on the display **9***a* serving as the display unit.

As described above, the control circuit **71** of the present configuration is one example of a partial area specifying unit and a counting unit which is configured to execute instructions for specifying multiple partial areas by subdividing the cuttable area and instructions for counting cut count cnt of the pattern for each of the partial areas while further executing instructions for storing the count obtained by the instructions for counting. Still further, control circuit **71** executes instructions for notifying information pertaining to cut count cnt associated with each of the partial areas through the notifying unit based on the count stored in the instructions for storing.

According to the above described configuration, when the pattern is cut, the number of cuts made on holding sheet **10** represented as cut count cnt is counted for each partial area in the instructions for counting. Information on the resulting cut count cnt for each of the partial areas is notified by the notifying unit.

Accordingly, the user is allowed to perform the cutting operation using the partial area in which cut count cnt of the holding sheet is relatively small based the information pertaining to cut count cnt notified by the cutting apparatus **1**. Thus, the scratches on the holding sheet **10** will no longer be localized and the localized degradation of adhesiveness can also be suppressed, thereby suppressing the overall performance degradation of the holding sheet **10**.

Control circuit **71** is one example of a recommended area specifying unit and executes instructions for specifying a partial area within the cuttable area, in which cutting of a pattern is recommended, as a recommended area based on the count stored in the instructions for storing. The control circuit **71** executes instructions for notifying a result of specification of the recommended area by the instructions for specifying the recommended area.

Accordingly, the user will readily notice the recommended partial area within the holding sheet **10**. Using the recommended area, the user is allowed to perform a neat and smooth cutting operation.

Control circuit **71** executes instructions for displaying information pertaining to each of the partial areas of the cuttable area along with information pertaining to cut count cnt on the display unit which is capable of displaying various cut information described above.

Accordingly, information pertaining to out count cnt is displayed on the display unit along with information pertaining to each of the partial areas of the cuttable area. Thus, the user is able to visually recognize the cuttable area with ease.

Further, information pertaining to cut count cnt is displayed on the display unit such that the count associated with each of the partial areas is distinguishable from one another. Accordingly, the user is able to distinguish the count associated with each of the partial areas and is therefore able to grasp the status of use of the holding sheet **10** in more detail.

Still further, the count associated with each of the partial areas is displayed in color. Thus, the counts may be described in different colors in different partial areas to improve the visibility of the status of use of the holding sheet **10**.

The count associated with each of the partial areas need only be displayed by at least one of numerals, characters, and colors. For instance, in the cut history screen, in addition to base lines L**0** to L**3** and L**00** to L**50** of cuttable area A illustrated in FIG. **5**B, cut counts cnt**1** to cnt**15** associated with each of the partial areas maybe displayed instead of the area identification numbers (1, 1) to (5,3) associated with each of the partial areas. Cut counts cnt**1** to cnt**15** may be represented by a relative scale such as "large" and "small" indicated in characters. Still alternatively, cut counts cnt**1** to cnt**15** may be indicated in 3 or more colors depending upon the level of cut counts cnt**1** to cnt**15** associated with each of the partial areas.

The above described configuration is not limited to the above description or the referred drawings but maybe modified or expanded as follows.

In addition to the above described configuration directed to cutting apparatus **1** comprising a cutting plotter, other configurations directed to different types of apparatuses provided with a cutting feature fall within the scope of the disclosure.

The notifying unit is not limited to the display **9***a*. Information on cut count cnt may be notified by audio outputted through, for example, a speaker.

The displaying of information pertaining to cut count cnt is not limited to the above described style but may be replaced by other approaches. For example, base lines L**0** to L**3** and L**00** to L**50** indicating cuttable area A may be replaced by a table and character information such as those exemplified in FIG. **8** to distinguish each of the partial areas with a listing of cut counts cnt**1** to cnt**15** associated with each of the partial areas.

The partial area specifying unit being was configured to read information pertaining to multiple partial areas which was subdivided in advance, for example, in n×m partial areas. Alternatively, the user may be allowed to variably specify the "n" and "m" values.

The selection of patterns and specification of cut locations may be implemented through the display **9***a* and a touch panel not shown being provided on the front face of the display **9***a* and having multiple touch keys comprising transparent electrodes. In such case, the touch keys may be depressed by the user's fingers or a touch pen to perform not only the selection of patterns and specification of cut locations but also to perform operations such as making various parameter settings and providing instructions for executing various functionalities.

The computer readable medium storing the control program is not limited to the ROM **72** provided in the cutting apparatus **1** but may come in various forms such as a CD-ROM, flexible disk, DVD, and memory card. In such case, the control program stored in the medium provides the operation and effect that are the same as those described in the foregoing configuration when executed by the computer of the devices provided with a cutting feature.

The storage device for storing the count of cuts is not limited to EEPROM **74** but may employ other types of storage devices such as a flash memory.

The foregoing description and drawings are merely illustrative of the principles of the disclosure and are not to be construed in a limited sense. Various changes and modifications will become apparent to those of ordinary skill in the art. All such changes and modifications are seen to fall within the scope of the disclosure as defined by the appended claims.

What is claimed is:

1. A cutting plotter comprising:

a processor; and

a memory storing computer-readable instructions, the instructions, when executed by the processor, causing the processor to perform:

setting a plurality of partial areas by dividing a cuttable area of a holding member, the cuttable area being an area in which a cutting object is to be detachably adhered;

counting a number of cuts by a cutting blade within the cuttable area for each of the plurality of partial areas;

storing each of count values associated with each of the plurality of partial areas in a storage portion, each of the count values being counted by the counting for each of the plurality of partial areas; and

notifying, based on the count values stored in the storage portion, information relating to the number of cuts for each of the plurality of partial areas.

2. The cutting plotter according to claim **1**, wherein

the computer-readable instructions further causes the processor to perform:

specifying at least one partial area from the plurality of the partial areas as a specified area based on the count values stored in the storage portion, the count value of the specified area being greater than the count values of the other of the plurality of the partial areas, and wherein

the notifying comprises notifying a result specified by the specifying.

3. The cutting plotter according to claim **1**, wherein

the notifying comprises sending a command to a display, the command indicating displaying information relating to the plurality of the partial areas and the number of cuts.

4. The cutting plotter according to claim 3, wherein the notifying comprises sending a command to the display, the command indicating displaying the count value as the information relating to the number of cuts.

5. The cutting plotter according to claim 4, wherein the notifying comprises sending a command to the display, the command indicating displaying the count value with at least one of numeral, character, and color.

6. The cutting plotter according to claim 2, wherein the notifying comprises sending a command to a display, the command indicating displaying the specified area in a condition different from that of the other of the plurality of the partial areas.

7. The cutting plotter according to claim 1, wherein the computer-readable instructions further causes the processor to perform:

determining whether the holding member is in mint condition based on an input received by an operation portion, wherein

the storing comprises storing a zero value as each of the count values associated with each of the plurality of partial areas in the storage portion, when the determining has determined that the holding member is in mint condition, and wherein

the notifying comprises notifying, based on the count values stored in the storage portion, information relating to the number of cuts for each of the plurality of partial areas, when the determining has determined that the holding member is not in mint condition.

8. A non-transitory computer-readable medium storing computer-readable instructions that, when executed by a processor of a cutting plotter, instruct the processor to execute steps comprising:

setting a plurality of partial areas by dividing a cuttable area of a holding member, the cuttable area being an area in which a cutting object is to be detachably adhered;

counting a number of cuts by a cutting blade within the cuttable area for each of the plurality of partial areas;

storing each of count values associated with each of the plurality of partial areas in a storage portion, each of the count values being counted by the counting for each of the plurality of partial areas;

notifying, based on the count values stored in the storage portion, information relating to the number of cuts for each of the plurality of partial areas.

9. The non-transitory computer-readable medium according to claim 8, wherein

the computer-readable instructions further causes the processor to execute steps comprising:

specifying at least one partial area from the plurality of the partial areas as a specified area based on the count values stored in the storage portion, the count value of the specified area being greater than the count values of the other of the plurality of the partial areas, and wherein

the notifying comprises notifying a result specified by the specifying.

10. The non-transitory computer-readable medium according to claim 8, wherein

the notifying comprises sending a command to a display, the command indicating displaying information relating to the plurality of the partial areas and the number of cuts.

11. The non-transitory computer-readable medium according to claim 10, wherein

the notifying comprises sending a command to the display, the command indicating displaying the count value as the information relating to the number of cuts.

12. The non-transitory computer-readable medium according to claim 11, wherein

the notifying comprises sending a command to the display, the command indicating displaying the count value with at least one of numeral, character, and color.

13. The non-transitory computer-readable medium according to claim 9, wherein

the notifying comprises sending a command to a display, the command indicating displaying the specified area in a condition different from that of the other of the plurality of the partial areas.

14. The non-transitory computer-readable medium according to claim 8, wherein

the computer-readable instructions further causes the processor to execute steps comprising:

determining whether the holding member is in mint condition based on an input received by an operation portion, wherein

the storing comprises storing a zero value as each of the count values associated with each of the plurality of partial areas in the storage portion, when the determining has determined that the holding member is in mint condition, and wherein

the notifying comprises notifying, based on the count values stored in the storage portion, information relating to the number of cuts for each of the plurality of partial areas, when the determining has determined that the holding member is not in mint condition.

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